

Short Report

## Automobile door entrapment – A different form of vehicle-related crush asphyxia

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### Abstract

Crush asphyxia involving motor vehicles usually occurs when a victim is trapped beneath a vehicle that slips from a jack while being worked on, or beneath a car that has rolled over during a crash. Two cases are reported where crush asphyxia resulted from quite different circumstances. Case 1: A 58-year-old woman was found dead trapped between her car door and frame. As she was alighting from the vehicle it had rolled forward trapping her between the semi-opened door and car frame when the door had wedged against a second parked vehicle. Case 2: A second 58-year-old woman was found dead, also trapped between her car door and frame. She had been leaning out of her car trying to pick up a newspaper when the car rolled forward. The open driver's door wedged against an adjacent pillar trapping her between the door and the frame. Both victims died from crush asphyxia. This form of automobile door entrapment represents a distinct subset of automobile-related asphyxial deaths and illustrates a particular and unusual set of circumstances that may result in unexpected traumatic death. Getting, or leaning, out of a vehicle that does not have the handbrake engaged may result in wedging of the victim between the semi-opened door and car frame if the car rolls forward and the door impacts against a nearby unyielding object. Correlation of the physical dimensions of the door and frame with markings on the victim's body will assist in reconstructing the terminal events.

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### 1. Introduction

Crush asphyxia refers to situations where individuals who have become trapped by significant weights are unable to breathe because of compression and splinting of their chest walls. A classic example is that of an adult male working under a car who is crushed when the vehicle slips off a jack.<sup>1</sup> One of the first descriptions of crush asphyxia was by Ollivier in 1837 of a victim crushed in a crowd in Paris<sup>1</sup> and a form of homicide where the victim was compressed by the weight of his assailant became known as 'burking' in Victorian Edinburgh, after the body snatchers

Burke and Hare.<sup>2</sup> The following two cases are presented to demonstrate a specific, although rare, situation where crush asphyxia due to a vehicle may occur from quite a different mechanism.

### 2. Case reports

**Case 1:** A 58-year-old woman was found dead trapped between a car door and frame. It appeared that when she had stepped out of her stationary car it had rolled forward down a driveway causing her to place her foot on the brake pedal through the open door. She had become trapped between the semi-opened door and the car frame when the car door had wedged against a second parked vehicle. A passer-by discovered her body.

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The possibility of inflicted injury was raised given the unusual nature of the death and a crime scene investigation was initiated. Linear horizontal scratches were present along the driver's door that reflected the area of impact with the back left hand corner of the adjacent parked vehicle (Fig. 1). The body showed areas of linear blanching of the side of the face, the lower chest and the back (Fig. 2), with an oblique linear indentation on the back of the right calf. The distance from the ground to the doorsill was 260 mm and from the ground to the roof was 1360 mm. The pressure markings on the side of the face corresponded to the edge of the roof, the markings on the calf to the position of the doorsill and the markings on the back to the edge of the doorframe. Markings on the chest corresponded to projections on the inside of the door. There was no trauma to the face, neck, hands, mouth, teeth or genitalia. At autopsy there was congestion of the face with occasional conjunctival petechiae. Compressive injury to



Fig. 1. Scratches along the door of the victim's motor vehicle in case 1 where it had impacted with the rear of a second stationary vehicle on the left. Paint flakes along the scratches matched the second car. The 58-year-old victim was found wedged between the half-opened car door and frame. (Note: in Australia vehicles are right hand drive).



Fig. 2. Linear markings on the back of the victim in case 1 corresponded to the car frame.

the chest had caused bilateral anterior rib fractures. There was no other significant trauma and toxicological analyses of blood revealed only a therapeutic concentration of verapamil. There were no organic diseases present that could have caused or contributed to disease. As there was no evidence of assault or the involvement of another person, the death was attributed to accidental crush asphyxia.

**Case 2:** A second 58-year-old woman was found dead, also trapped between a car door and frame. She had been leaning out of her car (a small hatch-back with automatic transmission) trying to pick up a newspaper at the front gate of a rural property when the car rolled forward. The open driver's door contacted a pillar at the entrance to the property trapping her between the door and the frame. A neighbour discovered her body approximately 45 min later. Witnesses reported hearing a car horn sounding three times earlier that morning but had not investigated.

At autopsy there were a number of ants on the body that had caused confluent areas of parchenting. The facial skin above the neck was extensively suffused and there were widespread facial petechiae. The conjunctivae were congested with coarse petechiae. There was a bruise/abrasion over the left angle of the mandible and bruising with abrasion over the right posterolateral thorax, beneath which there was extensive haemorrhage into soft tissues. There was a solitary fracture to the right 5th rib with adjacent diaphragmatic haemorrhage. A formal neck dissection did not show evidence of blunt injury to the larynx but there were prominent supra and infraglottic mucosal petechiae. There was vertically oriented subvisceral pleural haemorrhage on the posterolateral aspect of the right upper and lower lobes of the lung. There was no significant natural disease identified. Toxicological analyses showed no findings of significance. Death was due to crush asphyxia.

### 3. Discussion

Crush asphyxia forms part of the spectrum of asphyxial deaths when a victim is compressed beneath an object or under heavy materials. It includes situations where a child or worker is trapped in a trench by soil or sand, or a victim is buried beneath rubble after an earthquake or building collapse, or is crushed in a crowd.<sup>3–6</sup> Crush asphyxia differs from positional asphyxia, as respiratory compromise in the latter is caused by splinting of the chest and/or diaphragm preventing normal chest wall movement, or else by blockage of the airway due to an abnormal position of the head or neck, with or without significant compression. In occasional cases both crush and positional asphyxia may play a role in the terminal episode. Certain situations such as wedging between mattresses and walls, and crushing under furniture or soda pop vending machines are age-dependent.<sup>7–9</sup>

The pathological features in crush asphyxia are usually quite characteristic, with intense engorgement of the face and neck and showers of petechial haemorrhages of the

skin of the face and the conjunctivae. There may also be subconjunctival haemorrhages, oedema and epistaxis.<sup>3,10,11</sup> However, these features may not always be prominent, even with clear histories and scene findings of entrapment, as was seen in case 1. Particular markings from clothing may also occur with reduced numbers of petechiae under tight clothes due to compression of the vasculature.<sup>12</sup>

Crush asphyxia involving motor vehicles may arise in a number of ways in addition to the reported circumstances. As was mentioned earlier, crushing under a car that has slipped from a jack onto the chest of a victim may occur, usually resulting in rapid demise unless the compression can be alleviated in a timely fashion. This may also happen if a victim becomes entrapped beneath a vehicle in a roll-over. Victims in motor vehicle crashes are also sometimes at risk of crush asphyxia if there has been significant disruption of the structure of the vehicle with intrusion of parts of the frame into the cabin resulting in torso compression,<sup>13</sup> or if they are compressed beneath other unconscious or dead occupants. Other causes of asphyxia in vehicles include neck flexion, inversion, facial occlusion and blood aspiration.<sup>13</sup> Entrapment of a pedestrian between a car and a wall or another solid object may also result in lethal crush asphyxia.

Other types of asphyxial deaths involving motor vehicles include carbon monoxide inhalation with reduction in oxygen carrying capacity of the blood and diminution of cabin oxygen levels in suicide attempts, or in fires. Potentially lethal displacement of oxygen may occur with recreational inhalation of gases such as nitrous oxide within closed vehicle cabins. Intoxicated or unconscious individuals may also be left in positions after crashes where there is splinting of the chest or angulation of the head in the confined space in the cabin resulting in positional asphyxia. Hanging has occurred from seat belts, either due to an accident or to suicide.<sup>14,15</sup> Inhalation of blood following craniofacial trauma, or less-commonly soil, have also resulted in choking after crashes,<sup>16</sup> and entrapment in a submerged vehicle has resulted in drowning (Table 1).

In the reported cases crush asphyxia occurred when the victims had been trapped between car doors and frames after their vehicles had rolled forward. The instinctive response of the victim in case 1 to attempt to stop her car by depressing the brake pedal had placed her between the car door and frame, an extremely vulnerable position once the car had rolled against another car. In case 2 the victim had been leaning out of the car to collect a newspaper when the car had rolled forward against a pillar. In both cases the victims had been located between the doors and frames of their cars and had not been able to extricate themselves when forward movement of the vehicles had caused the car doors to impact against another object. Continued pressure on the victims' chests had caused their deaths from crush asphyxia with characteristic findings at autopsy.

The unusual nature of the death in case 1 had resulted in a substantial police presence at the death scene with con-

Table 1

Causes of asphyxial deaths related to motor vehicles

*Crush asphyxia*

Compression beneath a vehicle  
 Compression within a vehicle from structural disruption  
 Compression within a vehicle beneath other occupants  
 Entrapment between a vehicle and solid object  
 Entrapment between a door and frame (current cases)

*Gas inhalation*

Carbon monoxide  
 Nitrous oxide

*Positional asphyxia*

Associated with impaired conscious state/entrapment

*Hanging*

From seat belts

*Choking/suffocation*

Aspiration of blood from craniofacial trauma  
 Inhalation of soil after a vehicle crash  
 Facial compression

*Drowning*

Entrapment in a submerged vehicle

cerns that there may have been involvement of another person in the death. However, careful examination of injuries at the scene and correlation with features of the car frame and door soon confirmed the position of the body at death, the absence of any other inflicted injuries, and the likely accidental nature of the death.

In conclusion, these cases have demonstrated two similar deaths caused by crush asphyxia from compression of victims between car frames and doors. These deaths differ from more usual forms of crush asphyxia caused by motor vehicles and illustrate another potentially dangerous scenario if a vehicle moves forward when the driver is between the car and an open door. Evaluation of linear markings on the body at the scene before lividity occurs and correlation with car door and frame structures provides a clear indication of the position of the body at the time of death. This information may be used to support the likelihood of an accidental death.

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